

**PRS: Physics Reconstruction and Selection
HCAL/JetsMET group**

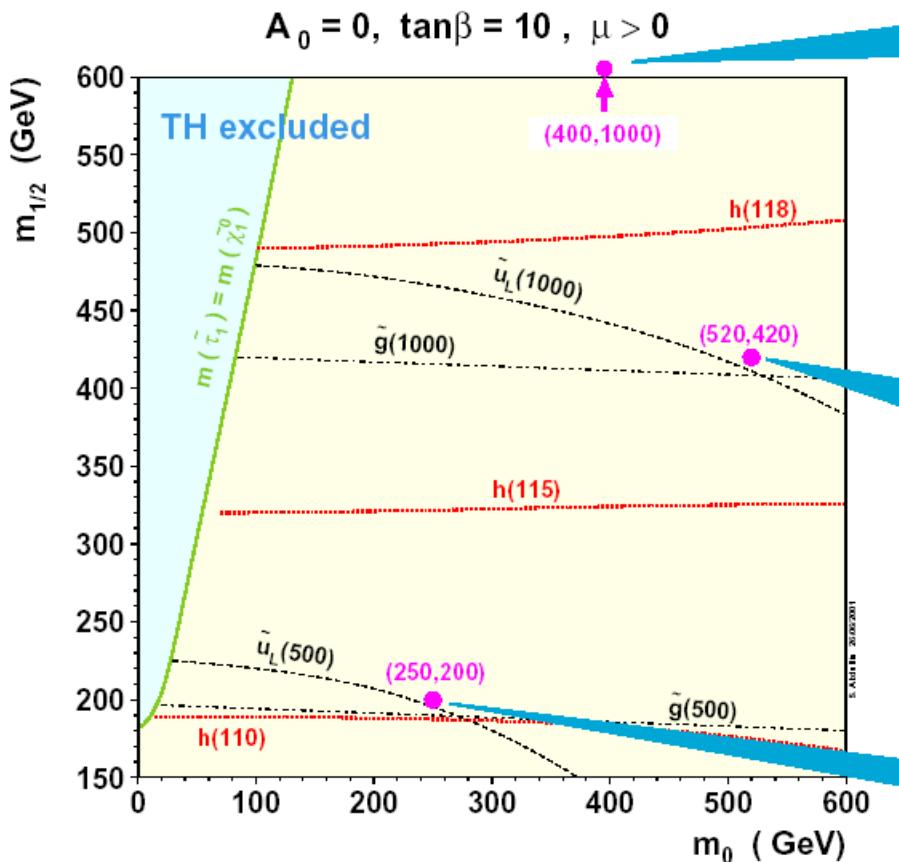
L2/Offline MET

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Shuichi Kunori**

05-March-2002



SUSY: Probing Points



$m(\tilde{\chi}_1^0) = 423$ GeV $m(h) = 121.9$ GeV

$m(\tilde{g}) = 2154$ GeV $m(\tilde{u}_L) = 1993$ GeV

$\sigma \sim 18$ fb, requires $\int Ldt \sim 20-25$ fb $^{-1}$

typical cuts: $E_T > 800$ GeV, $N_j \geq 2$

3

$E_T^j > 300, 150$ GeV

$m(\tilde{\chi}_1^0) = 177.5$ GeV $m(h) = 116.8$ GeV

$m(\tilde{t}_1) = 726$ GeV

$\sigma = 2.24$ pb, requires $\int Ldt < 100$ pb $^{-1}$

typical cuts: $E_T > 300$ GeV, $N_j \geq 3$

2

$E_T^j > 200, 100, 50$ GeV

$m(\tilde{\chi}_1^0) = 79.0$ GeV $m(h) = 110.7$ GeV

$m(\tilde{t}_1) = 352$ GeV

$\sigma = 115$ pb, requires $\int Ldt < 10$ pb $^{-1}$

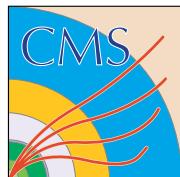
typical cuts: $E_T > 200$ GeV, $N_j \geq 2$

1

$E_T^j > 100, 50, 50$ GeV

- Typical off-line signal efficiency : 20 - 70 % (@ 0.5 - 2 TeV)

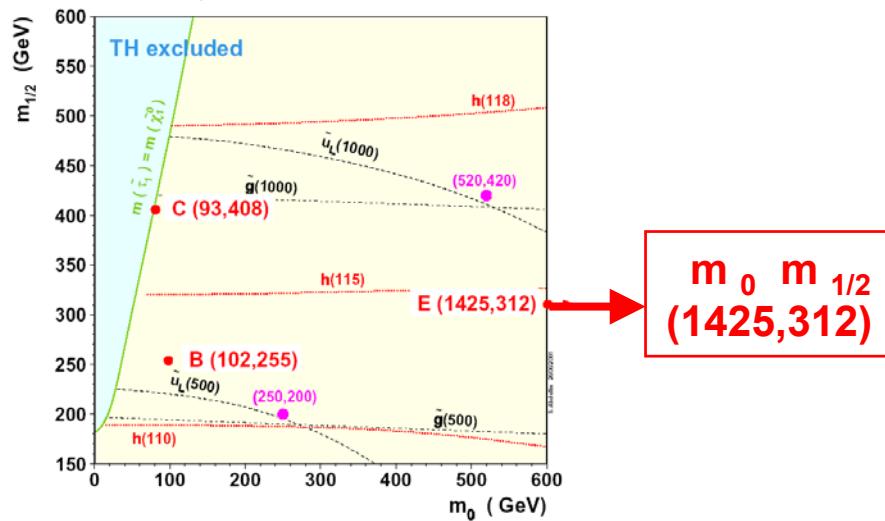
(S.Abdullin)



Complex SUSY Channel

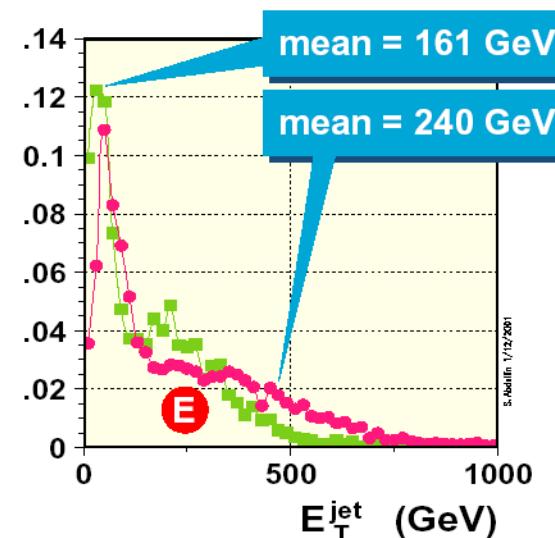
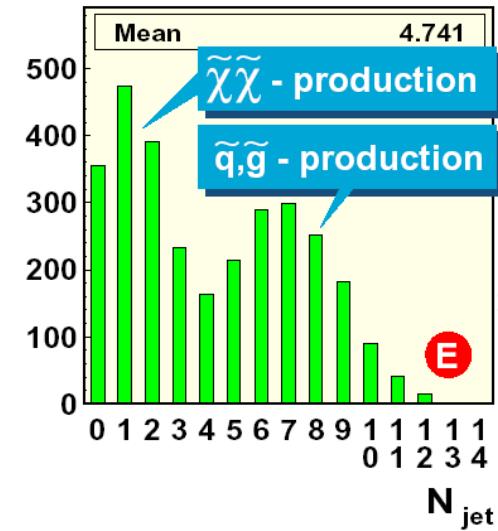
- an example -

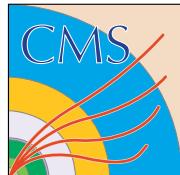
$A_0 = 0, \tan\beta = 10, \mu > 0$



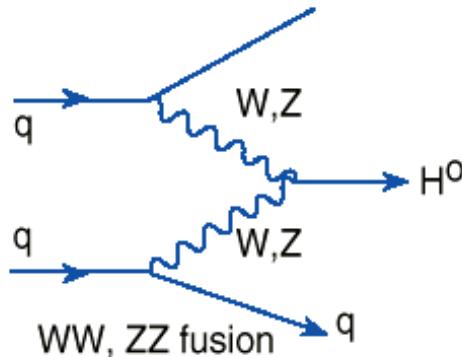
M_h 116GeV
 M_{gluino} 804GeV
 M_{squark} 1500GeV

(a SUSY point from hep-ph/0105204)





qqH(120), H→invisible



q
Invisible
(neutralinos)
(gravitinos)
q

Signal: $(\sigma * \text{BR})$ 4300fb (BR=1)

Background:

QCD Zjj

QCD Wjj

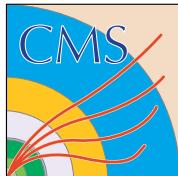
EW Zjj

EW Wjj

NB: tt is no more major background.

Event selection:

- **2 FWD tag jets**
 $\text{Et} > 40\text{GeV}$
 $|\Delta\eta| > 4.4, \eta_1^* \eta_2^* < 0.0$
 $M(jj) > 1200\text{GeV}$
- Between 2 FWD jets
no jet
 $\text{Et} > 20\text{GeV}$
no lepton
 $\text{pt}(m) > 5\text{ GeV}$
 $\text{pt}(e) > 10\text{GeV}$
- $\text{MET} > 100\text{GeV}$
- $|\Delta\Phi(jj)| < 1.0$



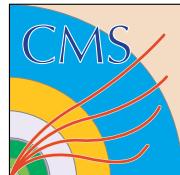
Reconstruction and Selection

MET Reconstruction

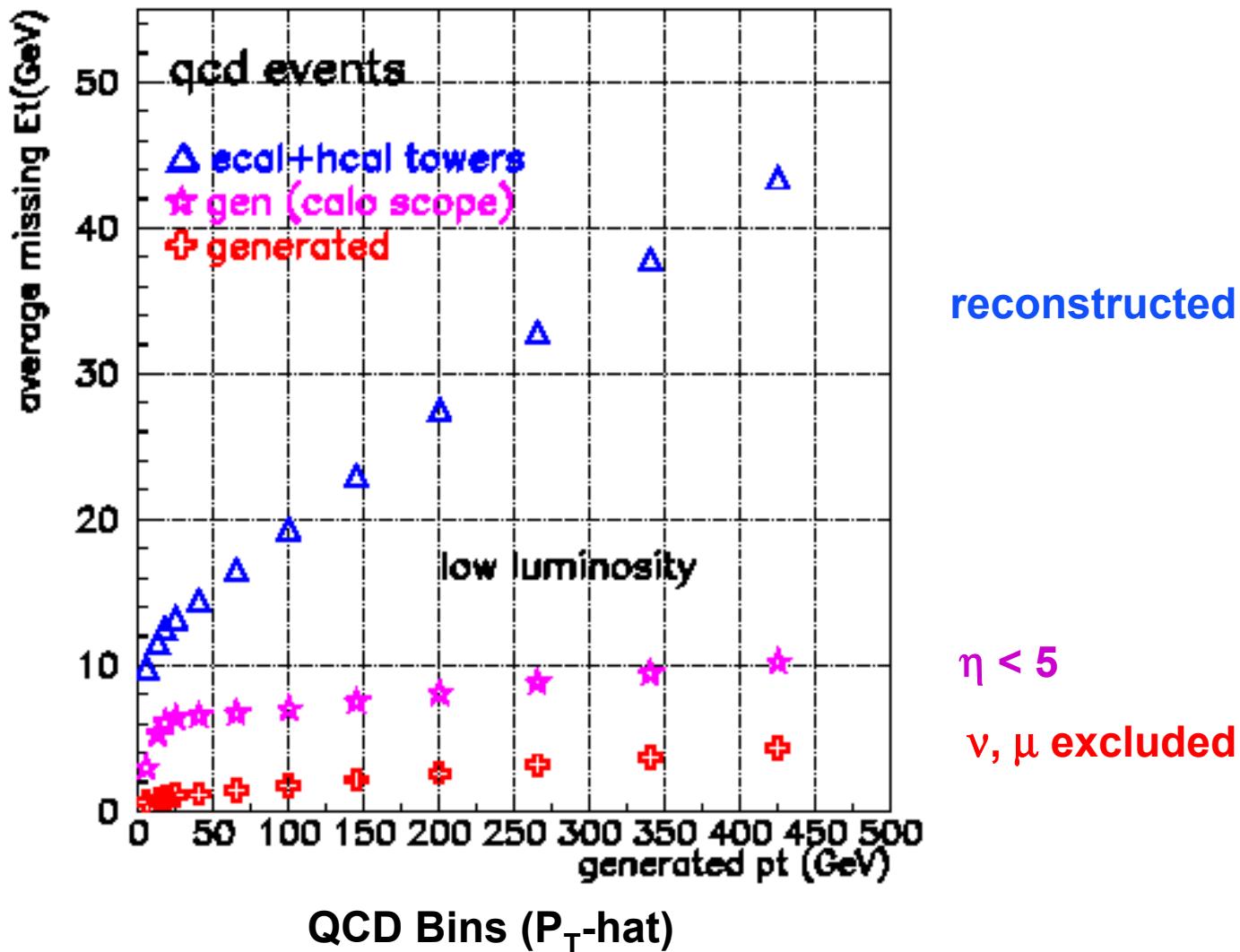
- Vector sum of E_T in ECAL+HCAL towers
 - Threshold $E_T(\text{tower}) > 0.5\text{GeV}$
- Energy scale correction (not applied in this analysis)
 - Jet energy correction for found jets and “min-bias” correction for outside of the jets (cone).

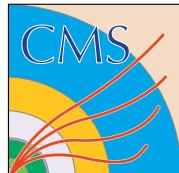
Event Selection

- Filter to remove abnormal events and/or channels
 - CMSIM120: large energy deposit in single readout
 - Due to 1) wrong choice of a GEANT parameter for energy loss and 2) memory collapse(?) in CMSIM
 - $E_T(1\times 1)/E_T(3\times 3) > 0.9$
 - Real detector:
 - Due to hot/noisy channel (for example)
- Topological cuts
 - Back to back jet veto for 1st & 2nd highest E_T jets
 - 1) no cut, 2) $|\delta\phi| > \pi - 0.5$



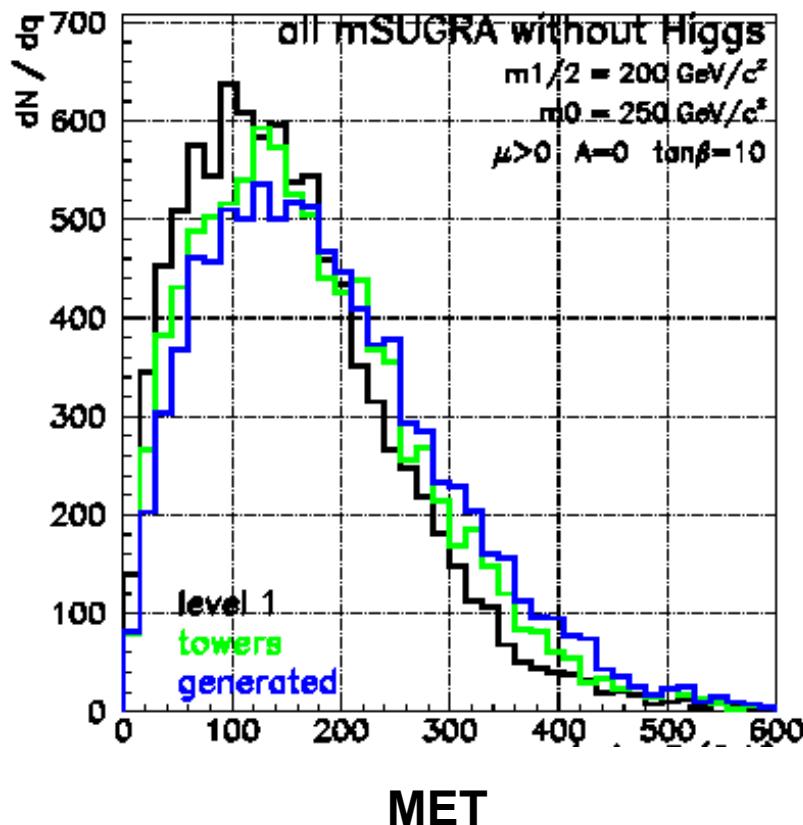
MET resolution



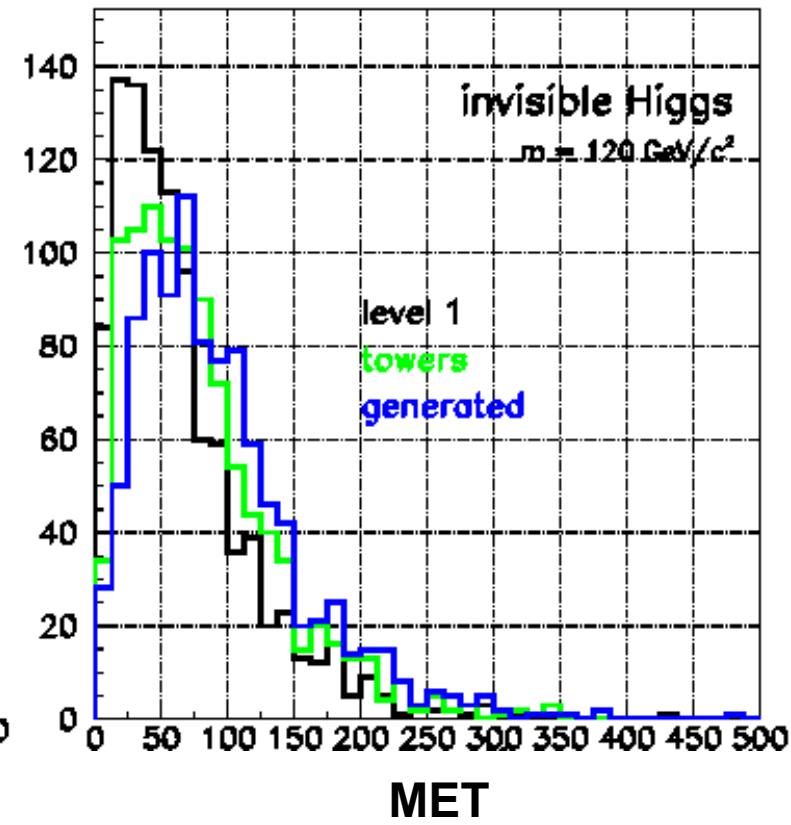


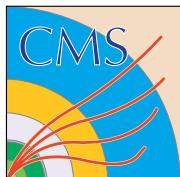
MET Distributions

SUSY



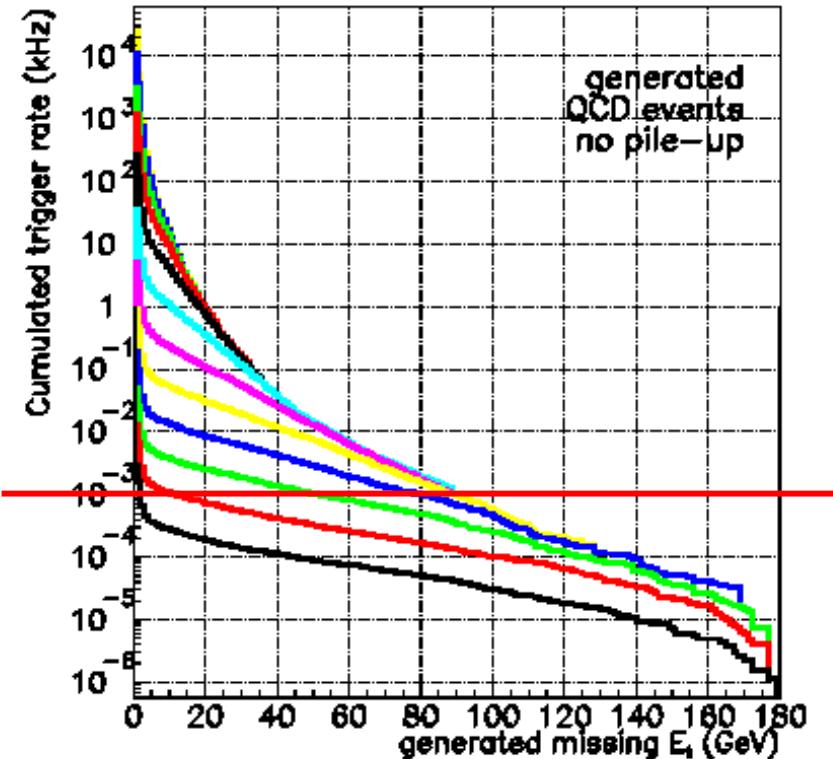
Invisible Higgs



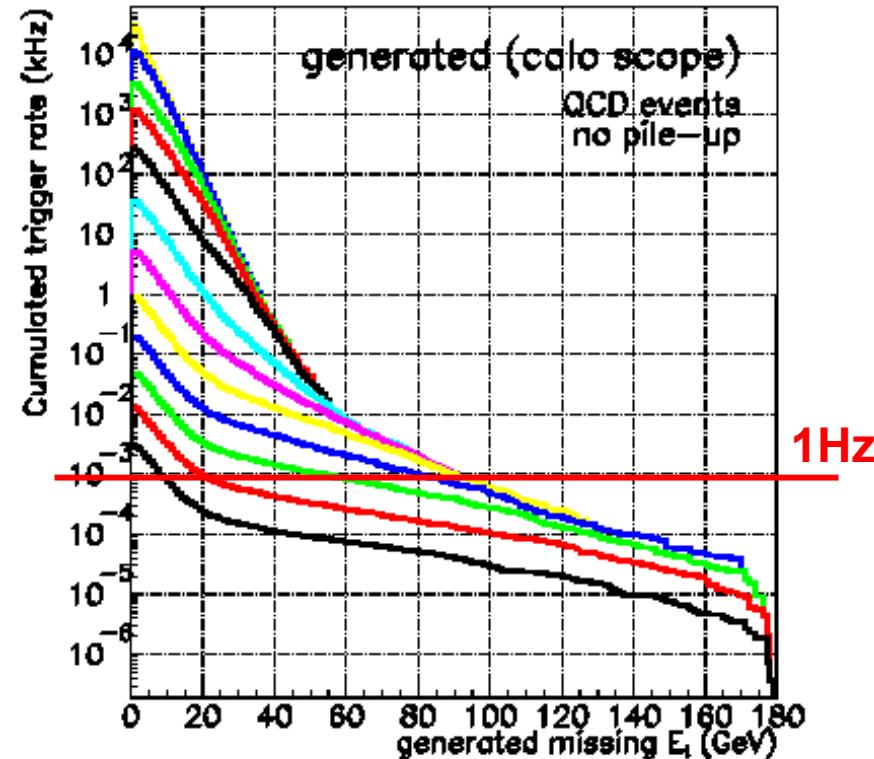


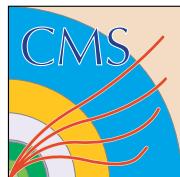
QCD jets: MET Rates Generated Particle Level

ν, μ excluded



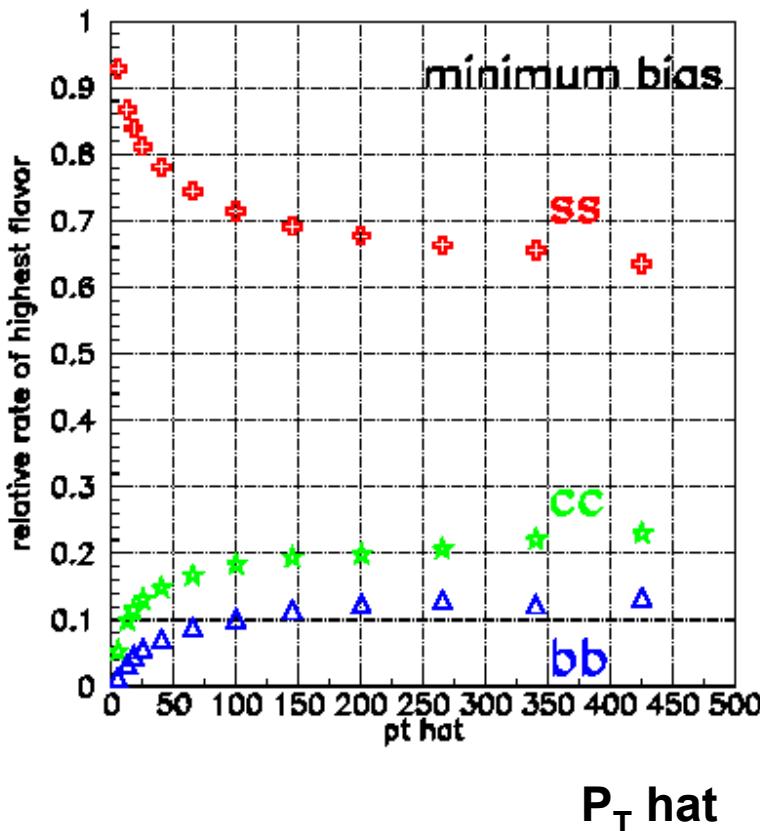
$\eta < 5$ (ν, μ excluded)



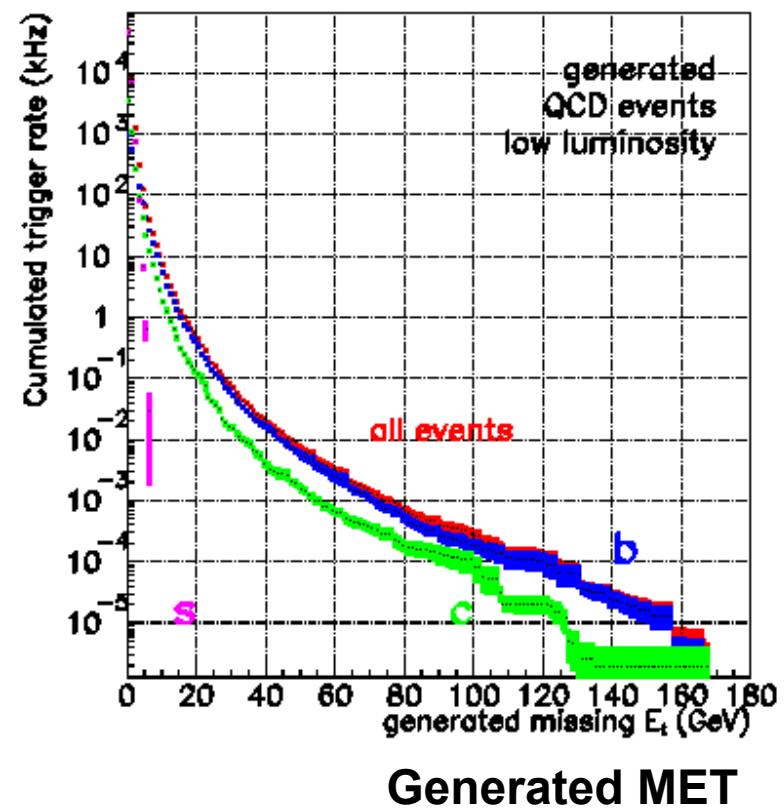


QCD Jets: Heavy Flavor Contribution

heavy flavor fraction



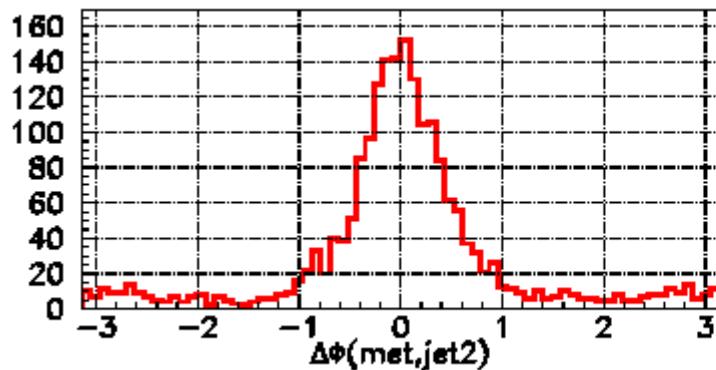
MET



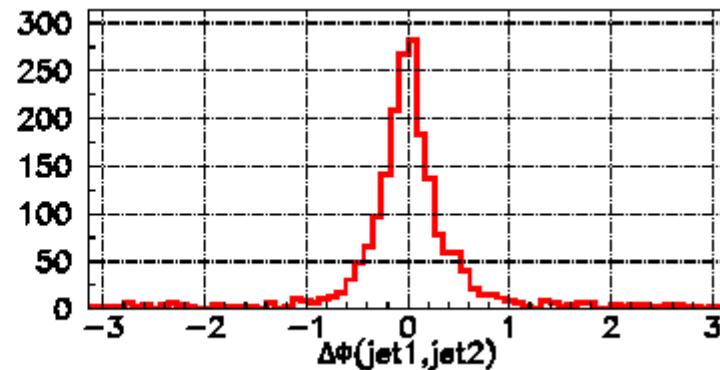
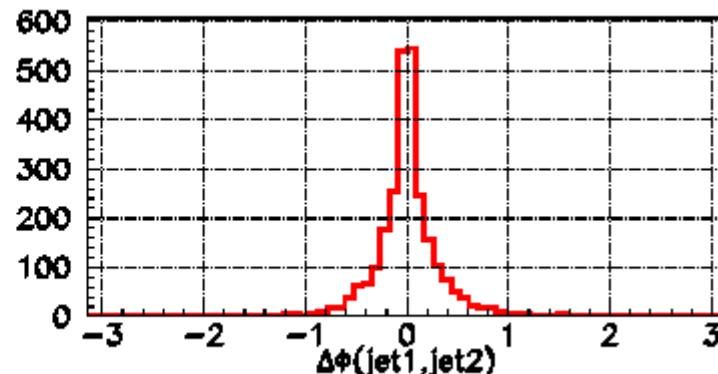
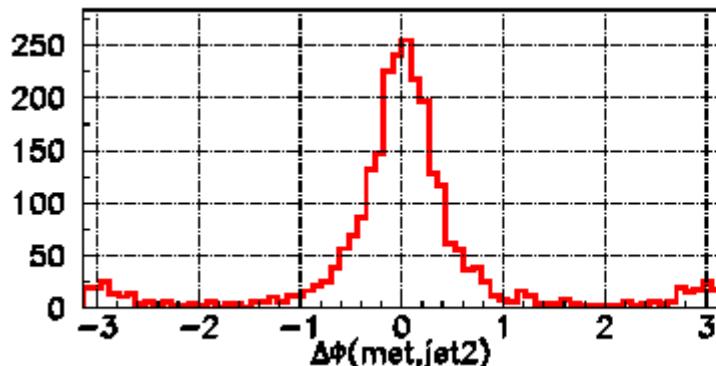
 $\Delta\phi$

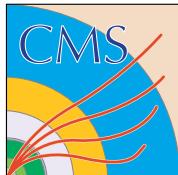
for MET > 50 GeV

MET vs Jet2

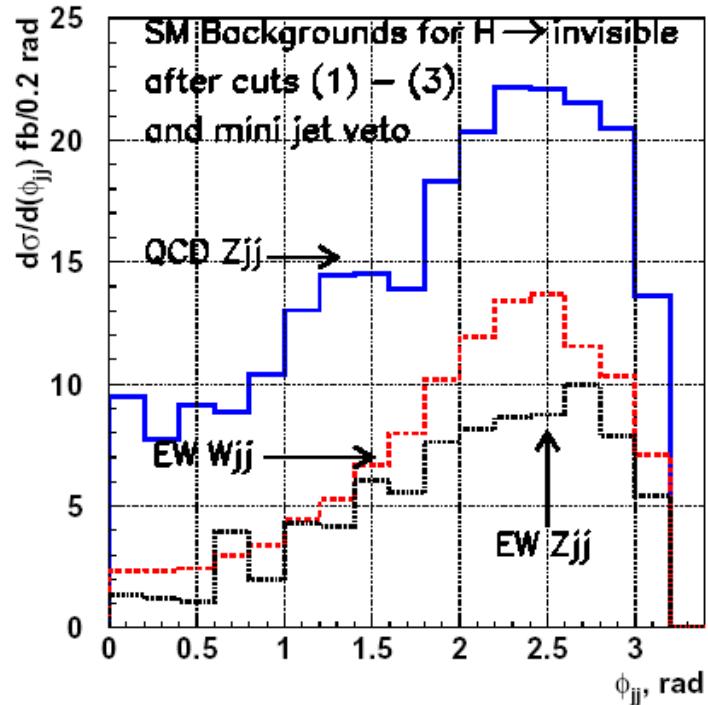
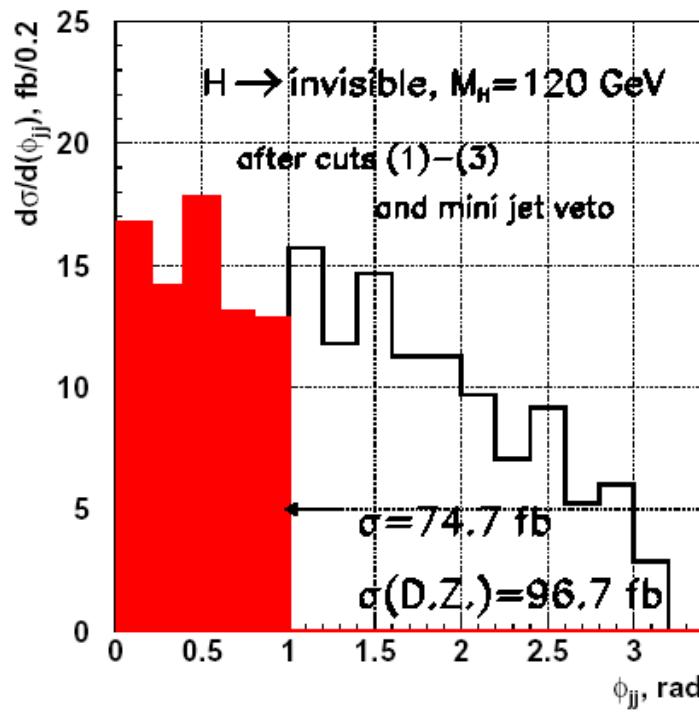
 $80 < \text{PT} < 120 \text{ GeV}$

Jet1 vs Jet2

 $380 < \text{PT} < 470 \text{ GeV}$ 



$\Delta\Phi_{JJ}$ cuts and results



	- this -	- DZ -
Higgs	74.7	(96.7) fb
QCD Zjj	48.0	(71.8)
QCD Wjj	job running	
EW Zjj	12.8	(14.8)
EW Wjj	8.9	(9.9)

(very preliminary)

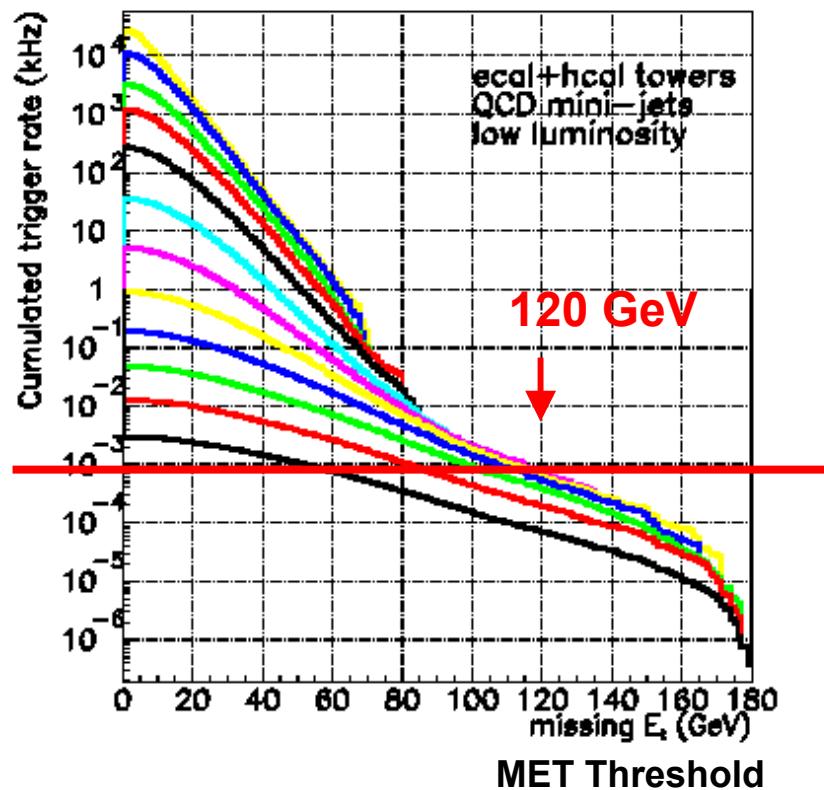
Set upper limit on
 $\sigma^* \text{BR}(H \rightarrow \text{inv})$

(A.Nikitenko & K.Mazumdar)

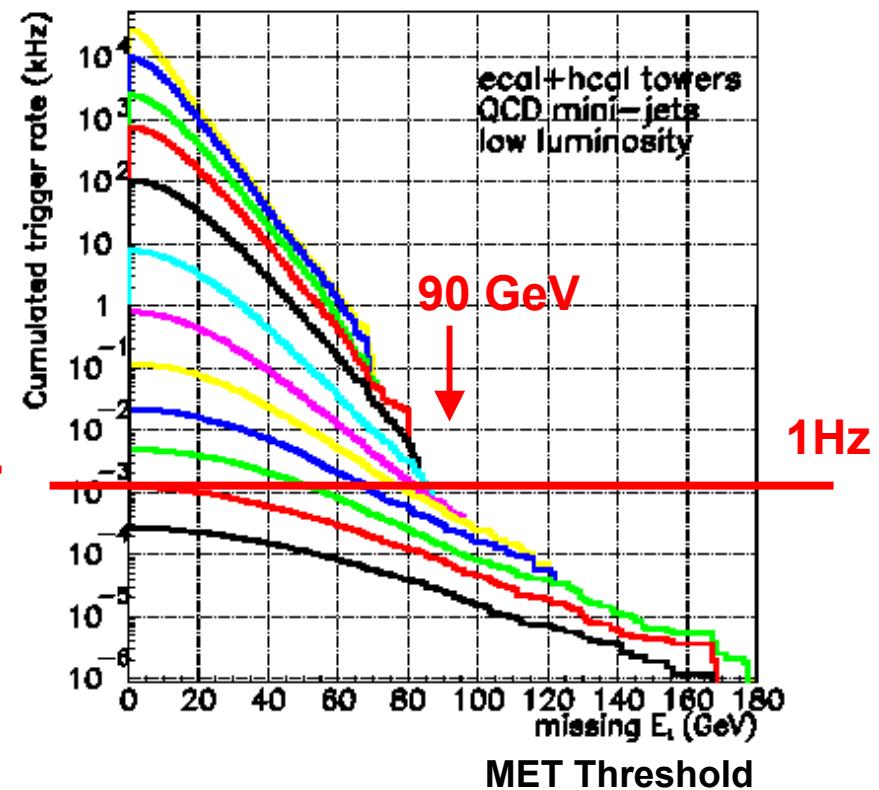


L2 without/with $\Delta\phi(1,2)$ cut

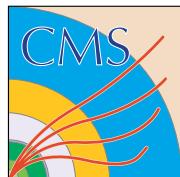
No $\Delta\phi(1,2)$ cut



$\Delta\phi(1,2)$ cut

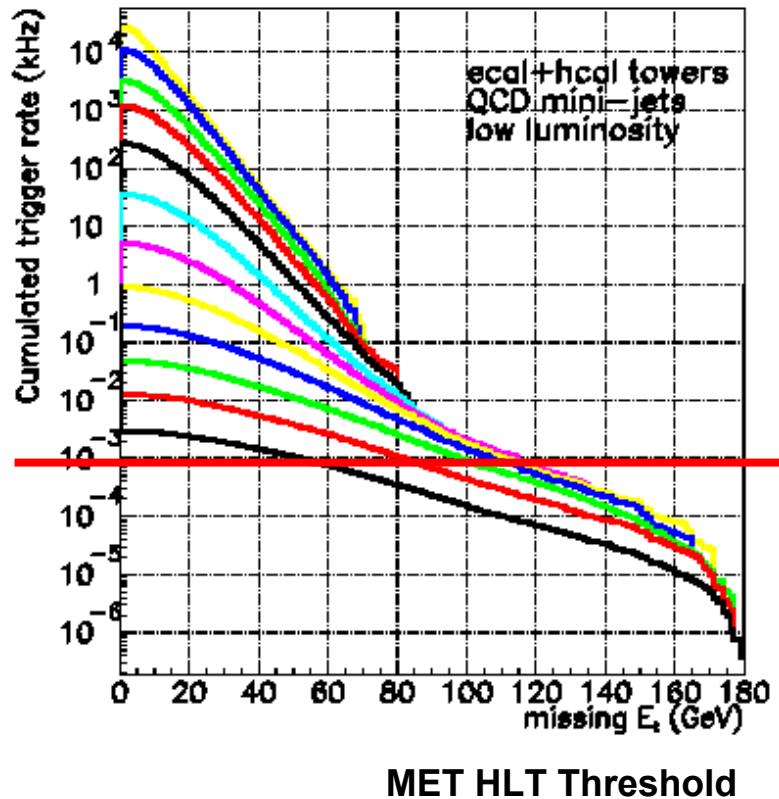


~10 reduction in rate with $\Delta\phi(1,2)$ cut

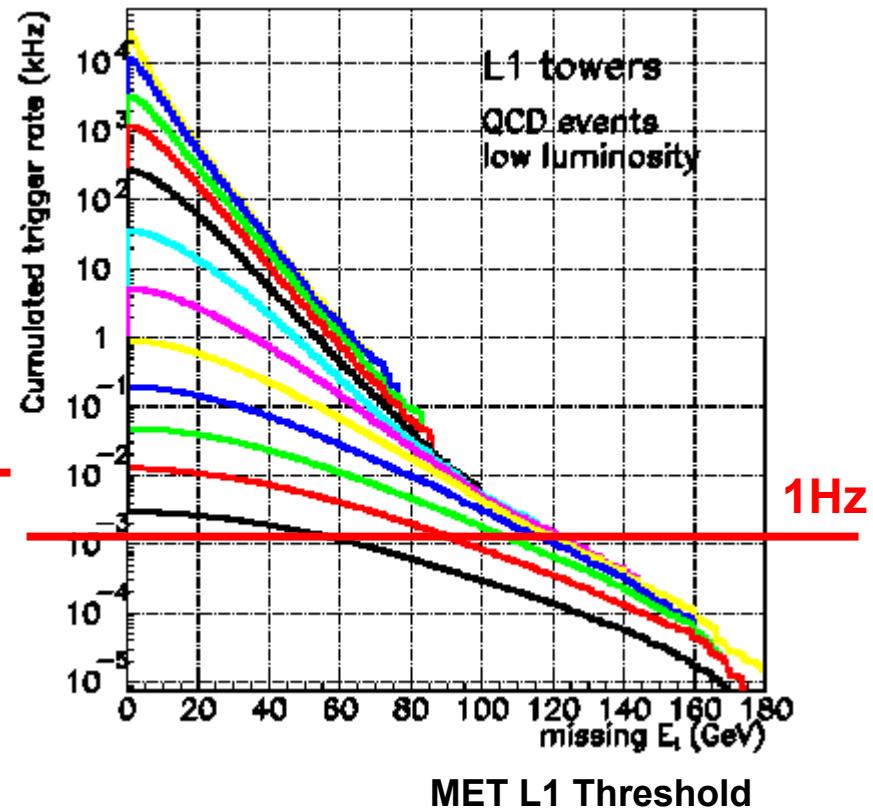


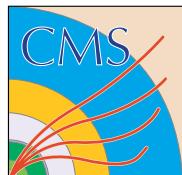
L2 (no $\Delta\phi(1,2)$ cut) vs L1

L2



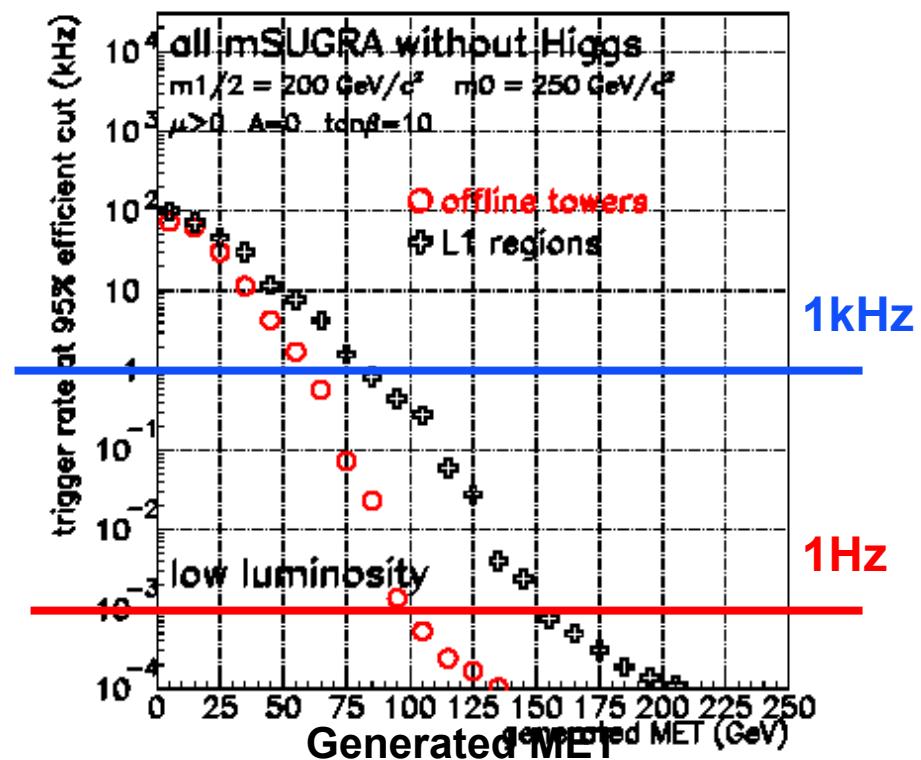
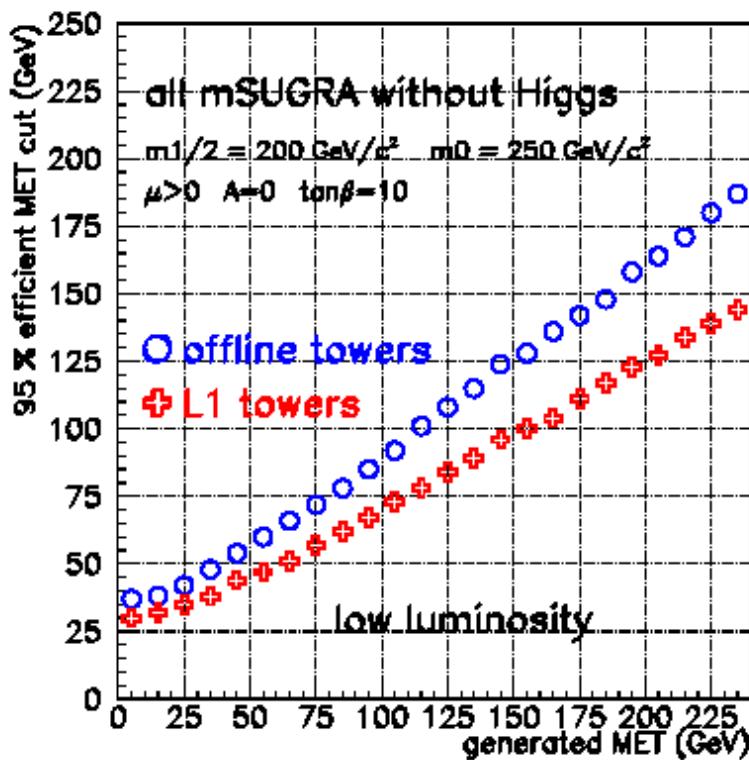
L1





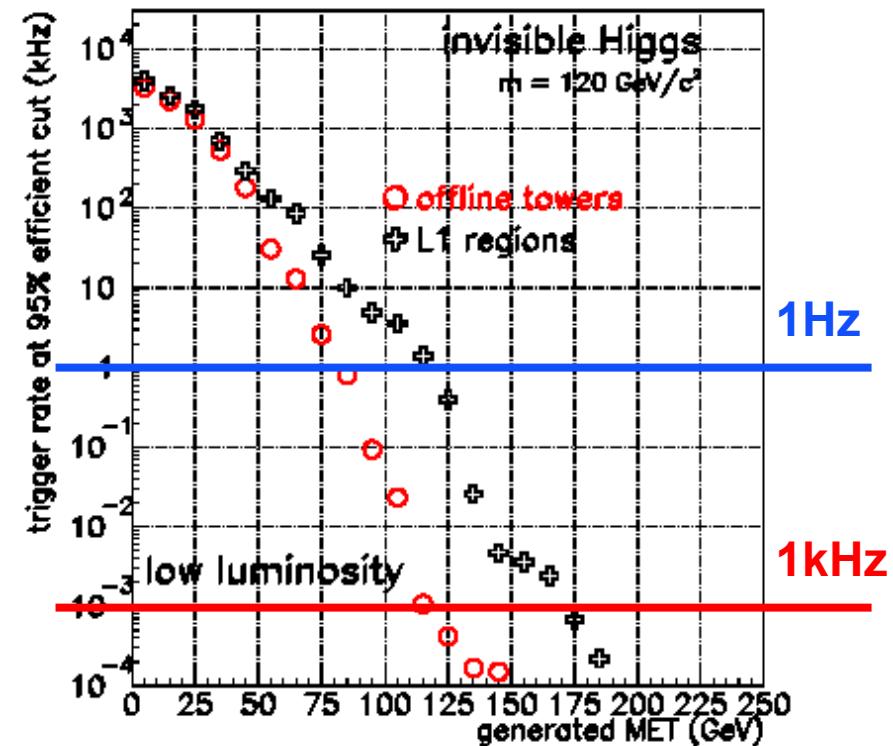
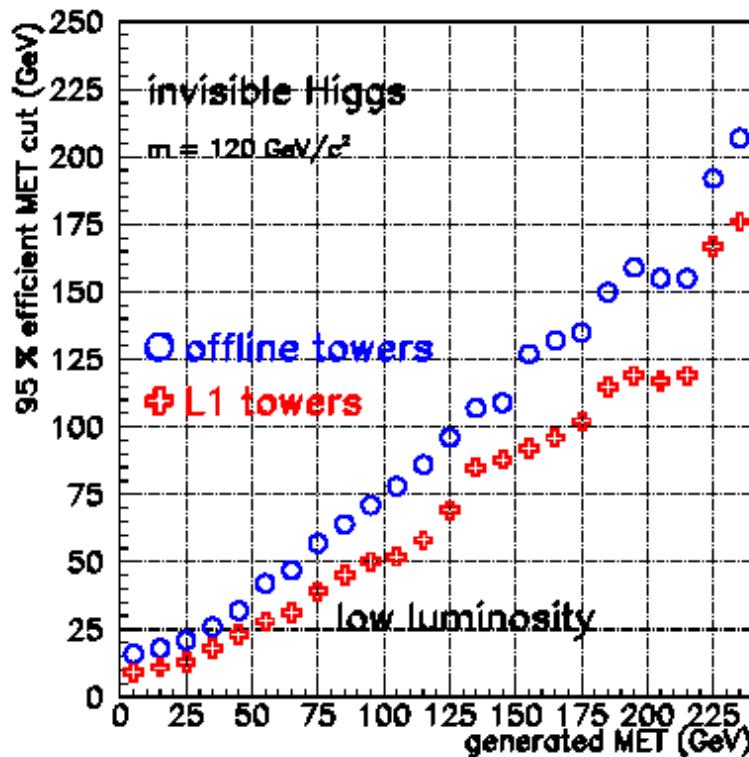
mSUGRA1

Trigger rates with 95% efficiency
as a func of generated MET

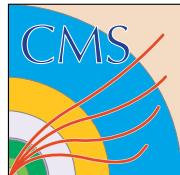


Invisible Higgs

Trigger rates with 95% efficiency
as a function of generated MET



Generated MET



Alternative HLT for Invisible Higgs

(A.Nikitenko)

with cut on :

$$E_T^J > 40 \text{ GeV}$$

$$|\Delta\eta_{JJ}| > 4.4,$$

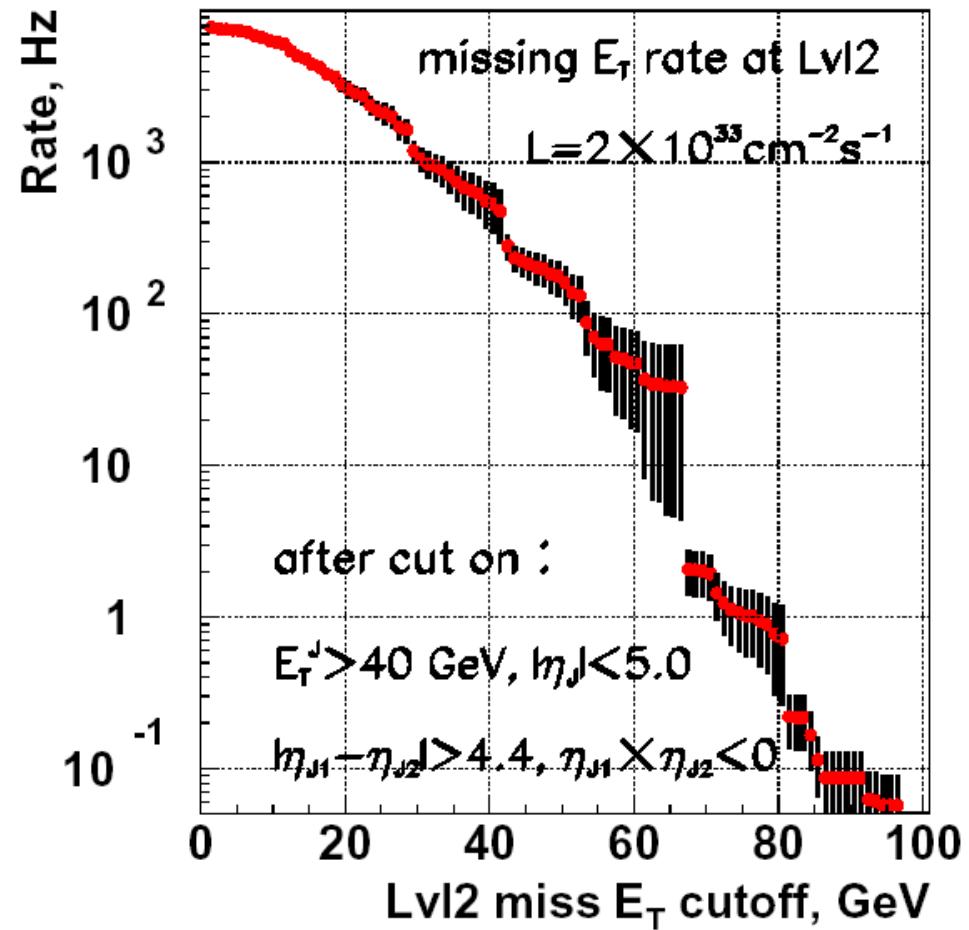
$$\eta_{j1}\eta_{j2} < 0$$

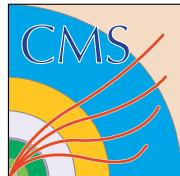
rate is 7.9 kHz

with additional cut

$$\text{MET} > 80 \text{ GeV}$$

rate is ~ 1 Hz





Summary

- 1. L2 MET Thresholds for 1Hz are**
 - 120GeV without $\Delta\phi(1,2)$ cut
 - ~90GeV with $\Delta\phi(1,2)$ cut
- 2. Need to implement MET energy scale correction with “jet correction”**
- 3. Need to understand source of difference in L2 and L1 MET resolution.**
- 4. Continue to look for algorithm to lower the MET threshold by**
 - Additional topological cuts
 - Improving MET resolution